JET PROPULSION LABORATORY INTEROFFICE MEMORANDUM
IOM 930-02-002/ECH
April 15, 2002

TO: Eugene Burke

FROM: Earnestine Hampton

SUBJECT: Cassini Gravitational Wave Experiment Assessment for October 20, through November 29, 2003

REFERENCE: Special Study request received from Bob Mitchell dated 20 February 2002.

INTRODUCTION

The contention period for January 2004, Weeks 01 – 05, was discussed at the February 2002 Resource Allocation Review Board (RARB) and the Resource Allocation and Planning Office (RAPSO) recommended that Cassini Gravitational Wave Experiment (GWE) incur daily gaps of 1 to 4 hours to reduce contention with MERA, MERB, and Deep Impact. The Cassini Project rejected the RAPSO recommendation and agreed to investigate the possibility of moving the GWE earlier in the November 2003 time frame or later in the February 2004 time frame. The Cassini Project has requested that RAPSO perform a special study to determine if Cassini can receive continuous coverage for GWE beginning October 20, 2003 through November 29, 2003.

LOADING STUDY CRITERIA

Cassini has requested that the following constraints be used in this study:

- Continuous 2-way data
- Viewperiods with 10 degree elevation constraint
- 20 minute overlap (station handover where possible)
- DSS-25 & 34M HEF Antennas (20kW TXR is required if 34M BWG Antenna is used)
- Exclude use of DSS-55 and 70M for the GWE

SUMMARY of RESULTS

The RAPSO team has reviewed the October 20 through November 29, 2003 time period and the preliminary results shows that the Cassini Goldstone and Madrid viewperiod is shared with CONTOUR, all the Mars missions, Ulysses, and Voyager 1. The Cassini Canberra viewperiod is shared by all of the above projects except for CONTOUR. It was also discovered that Cassini would lose the overlap between Canberra and Madrid using the 10-degree elevation constraint viewperiods. Cassini will

be required to use a split-pass once per week at DSS-25/15 to accommodate DSS Maintenance. The preliminary results further shows that Cassini will require the cooperation of other projects to willingly move their supports to the 34M Beam Wave guide antennas, DSS-24, 26, 34, and 55, in order to maintain continuous coverage at DSS-25, 45, and 65.

CASSINI GWE LOAD STUDY

Cassini is proposing to move the GWE from December 7, 2003 through January 23, 2004 to October 20 through November 29, 2003. The GWE requirements are for continuous two-way data collection, 20 minute station hand-overs, and utilizing DSS-25, 45, and 65 for all scheduled supports. The GWE require 20Kw transmit capability and excludes the use of the 70M and DSS-55 antennas. The scheduling scenario for Cassini GWE is to use full view at DSS-25 with a 20-minute handover to DSS-45; DSS-45 using minimum four to five hour passes with a 20-minute handover (when available) to DSS-65; and DSS-65 using six to eight hour passes with a 20-minute handover to DSS-25.

The projected unsupportable time for Cassini in Weeks 43 through 45 is less than 5 percent on the 34HEF antennas and at DSS-25. In Week 46, the projected unsupportable time is 15 percent on the 34HEF antennas and 8.5 percent at DSS-25. The 15 percent in unsupportable time in Week 46 is caused by CONTOUR Encke Encounter on DOY 316, back-up support for the Encke Encounter, and MERB EDL Tone tests scheduled on DOY 314 and 317 impacting CONTOUR on the 34HEF antennas. The projected unsupportable time for Weeks 47 and 48 is 8 percent at DSS-25 and 5 percent on the 34HEF antennas. The 8 percent in unsupportable time at DSS-25 is contributed to the increase in support for MERB TCM on DOY 325, Mars Approach for MERA and MERB, and CONTOUR TCM. (*See Figure 1)*

The viewperiod overlap chart, (*Figure 2*) shows that Contour has a maximum of 40 percent overlap in viewperiod with Cassini at Goldstone and Madrid. The Mars missions have a maximum of 30 percent view period overlap with Cassini at all three DSN subnets. Contour has a very short viewperiod at Canberra, which does not impact Cassini at DSS-45.

The problem area for Cassini begins at the end of Week 45 (DOY 313) and continues through Week 47 (DOY 327). This high activity period begins with CONTOUR's TCM-8 on DOY 313, TCM-9 on DOY 315, Encke Encounter on DOY 316, encounter and post encounter playback activities, and post encounter TCM on DOY 328. CONTOUR requires near continuous coverage on the 34M HEF antennas for all TCM supports, hot back-up support for TCM-9, continuous coverage during encounter week, and dual coverage during Encke Encounter on DOY 316. During this time, MERB also begins its high activity period in Weeks 46 and 47 with two EDL Tone Tests that requires an array of all Goldstone stations simultaneously for 4-hours plus pre- and post calibration on DOY 314 and 317 and TCM-B3 on DOY 325 requiring continuous coverage. These activities impact the continuous coverage for Cassini GWE both directly and indirectly. *(See Figure 3)*

A preliminary Resource Allocation Conflict Negotiation Plan was generated to determine what the real-impact of moving the Cassini GWE to Weeks 43 through 48. The detailed Conflict Negotiation Plan was created using maximum flexibility in the choice of DSN apertures assigned to the project/users to reduce resource contention while ensuring that all requirements were adhered to. The detailed Conflict Negotiation Plan supports the forecast data and shows that Cassini can receive continuous support utilizing DSS-25, 45, and 65 in Weeks 43 through 45 and Week 48. To get continuous coverage in Weeks 46 and 47, during the CONTOUR Encke Encounter and MERB activities, Cassini will be required to utilize DSS-54 or 55 and the cooperation of other project/ users.

CONCLUSION

In conclusion, Cassini will have a natural gap in coverage of 5 to 15 minutes due to required the 10-degree elevation constraint. Keeping this statement in mind, Cassini can receive continuous support from October 20 through November 8 without any contention or impact to other users. It is during weeks 46 and 47, CONTOUR Encke Encounter, MERB EDL Tone Tests, MERB TCM, and CONTOUR TCM activity that Cassini will require other project/users to move their supports to DSS-24, 26, 34, 55, and 70M antennas to maintain continuous coverage. The preliminary Resource Allocation Conflict Negotiation Plan supports the move of the GWE to the October 20 through November 29 time period. After conferring with the Multi-mission DSN Allocation and Planning Team (MDAP) on the antenna flexibility for MERA and MERB in weeks 43 - 48, it is recommended that the Cassini GWE be moved into this time period.

Copy:

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SUPPORTING DATA

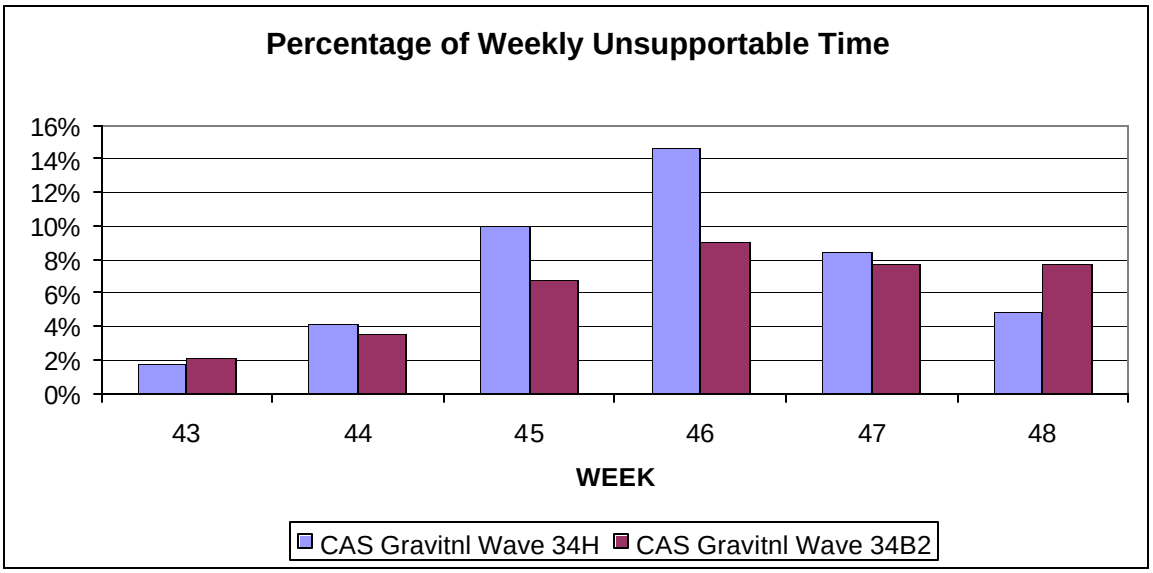

Figure 1

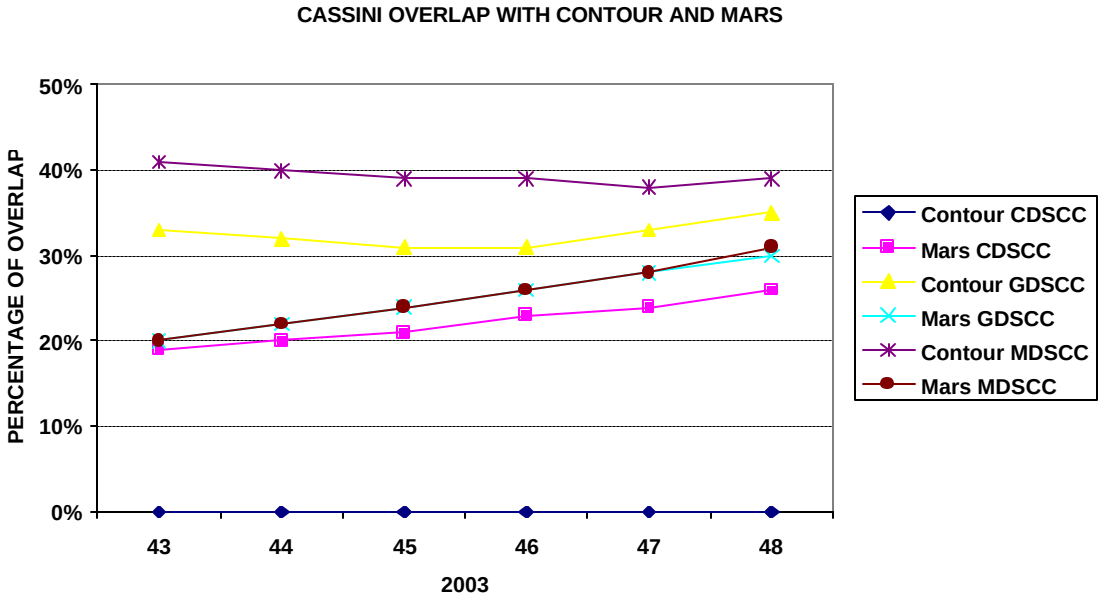

Figure 2

Key Events October 20 – November 29, 2003

MISSION	EVENT	START DOY	END DOY
Contour	TCM-8	DOY 313	DOY 313
	TCM-9	DOY 315	DOY 315
	ENCKE Encounter	DOY 316	DOY 316
	Encounter Data P/B	DOY 316	DOY 328
	TCM-10	DOY 328	DOY 328
Genesis	SKM-A5 Maneuver	DOY 323	DOY 324
Mars Odyssey	Themis II	DOY 167	DOY 219/04
MER–A	TCM-A3	DOY 311	DOY 311
	Approach Phase	DOY 324	DOY 003/04
MER-B	EDL Tone Test*	DOY 314	DOY 314
	EDL Tone Test *	DOY 317	DOY 317
	TCM B3	DOY 325	DOY 325
	Mars Approach	DOY 328	DOY 023/04
Mars Express	Approach Phase	DOY 297	DOY 358
Mars Global Surveyor	OS Maneuver* *	DOY 307	DOY 307
Nozomi	TCM	DOY 309	DOY 309
	Approach Phase	DOY 319	DOY 365

*(Goldstone all station array)

**No hard date, under negotiation

Figure 3